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Performance Monitoring, Fault Detection, Fault Localization Design Guidance

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Preface

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This report is a formal approach to standardize specifications and descriptions of performance monitoring, fault detection, fault localization (PM/FD/FL) for all disciplines, hardware, firmware, software, reliability, maintainability, configuration management, and integrated logistic support.

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PERFORMANCE MONITORING, FAULT DETECTION, FAULT LOCALIZATION DESIGN GUIDANCE

INTRODUCTION

Early attempts at Performance Monitoring, Fault Detection, and Fault Localization (PM/FD/FL) have largely been hit or miss with little consistent acceptance among the Navy or contractors with definitions or technical approach.

This report is a formal approach to standardize specifications and descriptions of PM/FD/FL for all disciplines, hardware, firmware, software, reliability, maintainability, configuration management, and integrated logistic support.

Although this report will be most useful in a new design and designs that use microprocessors, as applicable, this report should be useful in older designs including GFE and also in any designs that employ electrical or electronic components.

No attempts have been made in this report to predict, evaluate, or record failure trends or other failure analysis. Hopefully, this will be addressed in the future.

Using the approach described herein will help to determine whether or not PM/FD/FL designs are meeting design specification, performance, or contractual requirements both on the systems (macro view) level and also on the individual SEM module (micro) level. Testing and certification documentation for PM/FD/FL is addressed in depth.

This report is designed to help standardize and change the design, approach, certification, and testing of PM/FD/FL to a uniform engineering design. It is divided according to PM/FD/FL tasks and contains several appendixes. Appendix A contains statement of work samples; appendix B contains a glossary of terms. PM/FD/FL samples presentation slides, applicable data item descriptions (DIDs), and sample contract data requirements lists (CDRLs) are presented in appendixes C, D, and E, respectively.

PERFORMANCE MONITORING TASKS

TASK 101 PERFORMANCE MONITORING PROGRAM PLAN

101.1 Overview: The Performance Monitoring Program Plan shall be designed as a basic tool to assist the contractor in implementing an effective performance monitoring development program. The Government shall also use the plan to (1) evaluate the contractor's approach to, and his execution of, performance monitoring tasks; (2) evaluate the adequacy of his procedures for planning, implementing, and controlling the performance monitoring tasks; and (3) evaluate the ability of his organizational structure to focus on performance monitoring activities/problems.

101.2 Purpose: The purpose of Task 101 is to develop a Performance Monitoring Program Plan that identifies and integrates all program tasks necessary to accomplish performance monitoring requirements of the Prime Item Development Specification (PIDS) and the Statement of Work (SOW).

101.3 Task Description: The Performance Monitoring Program Plan shall be prepared to provide, as a minimum, the following:

1. A description of how the performance monitoring program will be conducted to meet the requirements of the PIDS and the SOW.

2. A description of how performance monitoring interfaces with total system design.

3. A detailed description of how each specific performance monitoring functional failure requirement will be performed or complied with.

4. The procedures to evaluate the status and control of each task and identification of the organizational unit with the authority and responsibility for executing each task.

5. A schedule with estimated start and completion points for each performance monitoring program activity or task.

6. The identification of known performance monitoring problems to be solved, an assessment of the impact of these problems on meeting specified requirements, and the proposed solutions or proposed plan to solve them.

7. The procedure or methods for recording the status of actions to resolve problems.

8. The designation of performance monitoring milestones, including design, review (PDR, CDR, IPR), and test.

9. The method by which the performance monitoring requirements are disseminated to designers and associated personnel and how design interfaces are accomplished.

10. Identification of key personnel for managing the performance monitoring program and the level of authority for problem resolution.

11. Description of the management structure, including interrelationship between line, service, staff, and policy organizations.

12. The performance monitoring design review checklist will be used to ensure that design meets requirements

When approved by the Government the Performance Monitoring Program Plan shall become a basis for evaluation of contractual compliance.

TASK 102 PERFORMANCE MONITORING PROGRAM DESIGN REVIEWS

102.1 Purpose: The purpose of Task 102 is to establish a requirement for the contractor to conduct formal and informal performance monitoring program design reviews.

102.2 Task Description: Performance monitoring formal design reviews shall be conducted in accordance with the requirements of MIL-STD-1521B on a schedule approved by the Government responsible agency. Informal performance monitoring in-process reviews shall be conducted at least quarterly until formal Critical Design Review (CDR) on a schedule mutually agreed upon by the Government responsible agency and the contractor. The contractor proposed formal and informal design review schedule shall be provided as part of the Performance Monitoring Program Plan.

In addition to the formal design review requirements of MIL-STD-1521B, the following formal and informal design reviews shall include the performance monitoring requirements indicated below:

1. Preliminary Design Review (PDR):

    a. Updated performance monitoring program status, including

        (1) performance monitoring modeling;

        (2) performance monitoring allocations;

        (3) performance monitoring predictions;

        (4) performance monitoring compliance with specifications and

        (5) design quideline criteria.

    b. Problems affecting performance monitoring.

    c. Performance monitoring critical items.

2. Critical Design Review (CDR):

    a. Performance monitoring compliance with specifications.

    b. Performance monitoring predictions and analyses.

    c. Performance monitoring critical items.

    d. Problems affecting performance monitoring.

    e. Identification of circuits where the design requires high reliability components and the software/firmware employs an extra-large number of lines of code.

3. In-Process Performance Monitoring Reviews(IPR):

    a. Discussion of those performance monitoring items previously listed in Sections 1 and 2.

    b. Results of performance monitoring test analyses.

    c. Test schedule: start and completion dates.

d. Performance monitoring parts, design, reliability, and schedule problems.

e. Status of assigned action items.

f. Contractor's assessment of performance monitoring design effectiveness.

g. Other topics and issues on the agenda agreed to by the contractor and the Government.

h. Results of applicable performance monitoring growth testing.

4. Test Readiness Review:

a. Performance monitoring analyses status and primary prediction.

b. Test schedule.

c. Test profile.

d. Test plan including failure definition.

e. Test report.

5. Production Readiness Review: Results of applicable performance monitoring growth testing.

TASK 103 PERFORMANCE MONITORING MODELING

103.1 Overview: Both quantitative and qualitative analyses are useful in determining where performance monitoring resources should be applied. The analyses identify improvements that must be made if requirements are to be met. In particular, the analyses are efficient work direction tools because they can confirm system adequacy or identify the need for design change, provided they are accomplished in conjunction with, or reviewed by, other disciplines.

103.2 Purpose: The purpose of Task 103 is to develop a performance monitoring model for making numerical allocations and estimates to evaluate system/subsystem/equipment performance monitoring effectiveness.

103.3 Task Description: A performance monitoring mathematical model based on system/subsystem/equipment functions shall be developed and maintained. As the design evolves, a performance monitoring block diagram (fault isolation groupings) with associated allocations and predictions for all elements in the FIG shall be created. The performance monitoring block diagram shall be keyed and traceable to the functional block diagram, schematics, drawings, and specifications. The model outputs shall be expressed in terms of performance monitoring requirements. As changes occur, the model shall be updated to include hardware or software/firmware design changes. The performance monitoring model shall be updated with information resulting from relevant tests and changes in item configuration.

TASK 104 PERFORMANCE MONITORING ALLOCATION

104.1 Overview: System performance monitoring requirements evolve in a number of ways, from informed judgments to analyses based on empirical data. The requirements are designed to minimize the total cost of developing, procuring, and operating the system during its life cycle. The integrity of the system is maintained by adequate top-down design that ensures the ability of the system to meet specified requirements.

104.2 Purpose: The purpose of Task 104 is to ensure that, once quantitative system requirements have been determined, they are allocated or apportioned to lower levels.

104.3 Task Description: Both the mission and mission integrity requirements shall be allocated to the level specified and shall be used to establish the baseline requirements for designers and software/firmware personnel. Requirements consistent with the allocations shall be imposed on all subcontractors and suppliers. The allocated values shall be included in appropriate sections of any procurement specifications, critical item specifications, and contract end item specifications to subcontractors/suppliers.

All allocated performance monitoring values established by the contractor and included in subcontract item specifications shall be consistent with the mathematical model required in Task 103.

TASK 105 PERFORMANCE MONITORING PREDICTION

105.1 Overview: Allocations are determined from the system performance monitoring requirements to provide lower level requirements which are levied on the designers and software/ firmware engineers. As design work progresses, predictions based on previously generated data and assessments based on program test data are used to determine whether the allocated requirement can or will be met.

Predictions combine lower level performance monitoring data to indicate equipment performance monitoring performance at successively higher levels, from subassemblies through subsystem to system. Predictions falling short of requirements at any level signal the need for management and technical attention.

105.2 Purpose: The purpose of Task 105 is to estimate the performance monitoring capability of the system, subsystem, equipment, hardware, and software/firmware and to determine whether or not the performance monitoring requirements can be achieved with the proposed design.

105.3 Task Description: Performance monitoring predictions shall be made for the system, subsystem, equipment, hardware, and software/firmware. The predictions shall include the probability of a functional failure, the probability of not diagnosing a performance fault, and the probability of incorrectly diagnosing a performance fault. Predictions shall be made (1) to show the ability of the performance monitoring function to assess system and subsystem integrity, (2) to provide a basis for life-cycle and logistic support analyses, and (3) to provide a basis for estimating system availability.

The predictions shall be made by using the associated performance monitoring block diagram and performance monitoring coverage data and shall be approved by the Government. Items and equipment shall not be excluded from the predictions for any reason.

TASK 106 PERFORMANCE MONITORING FAULT TREE

106.1 Overview: The performance monitoring fault tree is used as a basic tool by the contractor, the government program office, and the independent verification and validation (IV&V) groups to determine the path of initial fault observation to the final display.

106.2 Purpose: The specific purpose of the performance monitoring fault tree is to assist in designing, testing, and implementing an effective performance monitoring subprogram. The performance monitoring fault tree shall be used to evaluate the contractor's approach to, and confirmation of, adherence to PIDS requirements.

106.3 Task Description: The fault tree shall indicate each fault test point and the pass/fail levels at that test point. Each functional failure shall be labeled and described. This description shall include

1. All test points that are used to determine if a functional failure exists. Where a votive or count determination (e.g., 3 out of 5) exists, descriptions shall be supplied.

2. Identification of test points that are common to any other PM/FD/FL subprograms or tests.

3. The contractor's verification that determinations of performance monitoring faults to indicate a functional failure are direct, not made by inference or other indirect observations.

4. Proof that software/firmware programs that are used for determination are labeled and referenced to the configuration item where they are located.

TASK 107 PERFORMANCE MONITORING FUNCTION CERTIFICATION

107.1 Overview: It is vital that designs be tested, not only to see if the designs themselves are functional and fault free, but also that the designs meet not only the 'letter of the specification' but also meet the actual intent of the specification. Verification of design to specification should be performed at all levels of development and when it appears to have been completed, retesting and verification should occur, starting at the original design team, to contractor quality assurance personnel, to independent test teams, and finally by the Government.

107.2 Purpose: The purpose of this task is to verify and demonstrate that qualifying tests to show adherence to PIDS requirements are in enough detail, quality, frequency, and number to provide a high level of confidence.

107.3 Task Description: Task 107 performance monitoring function certification is a series of qualifying tests to determine adherence to the PIDS requirements. These tests shall be designed to answer, as a minimum, the following questions:

1. Did the performance monitoring function detect the fault?

2. Did the performance monitoring function indicate the proper operational status?

3. Did performance monitoring provide effective fault isolation information for corrective maintenance actions?

4. Did performance monitoring provide information for further tests that could affirm the problem?

5. Did the performance monitoring function provide information regarding the impact of the fault to the system?

6. What was the latency time between the occurrence of the fault and the final indication on the panel?

7. Was there any ambiguity surrounding the fault or the correction?

8. What are the total number of undetected faults in any given period? Why were they not detected?

9. What is the latency time from software/hardware fault to automatic rebooting?

10. What is the latency time to detect a problem in the computer firmware/hardware that is not correctable by automatic rebooting?

TASK 108 PERFORMANCE MONITORING INDEPENDENT VERIFICATION & VALIDATION

108.1 Overview: Independent performance monitoring verification and validation performed by a scientific team not involved in the design, development, and tests ensures that the performance monitoring design meets the PIDS requirements. The independent IV&V team will ensure that the performance monitoring subprogram will not fail and will perform to its intended capacity.

108.2 Purpose: The purpose of Task 108 is to independently determine that the PIDS and SOW requirements have been met.

108.3 Task Description: Procedures shall be independently established, maintained, and implemented, to be performed by test and analysis, to verify and validate the ability of the performance monitoring subsystem to meet all of the PIDS and SOW requirements. The functional testing of the design shall employ methodologies of great stress and strain to the hardware and firmware/software.

The performance monitoring subsystem shall be tested under worst-case actual operational conditions. The documentation produced by the IV&V team shall include but not be limited to

1. The test plan for the tests that will be conducted, including the operational conditions under which the tests will be performed.

2. The actual test procedures with dates, test engineer, location, and all other pertinent information.

3. Identification, description, listings, and source code for IV&V test programs.

4. Complete test reports, results, deficiencies, problems, and observations.

TASK 109 PERFORMANCE MONITORING CONFIGURATION MANAGEMENT OVERVIEW

109.1 Overview: Separate plans and procedures shall be prepared and adopted for the collecting, cataloging, and describing, of all designs, changes, implementations, problems, programs, test procedures, test results, test findings, conclusions, and observations for the performance monitoring program, subprogram, elements, hardware firmware/software.

109.2 Purpose: The purpose of this task is to verify and demonstrate the configuration management specifications, detail, quantity, quality, and media are sufficient to meet the requirements for the program.

109.3 Task Description: The contractor shall use a configuration management program for the performance monitoring system, subsystem, program elements, hardware, software/firmware, Enginering Change Proposals (ECPs), PDRs, listings of PIDs requirements (as interpreted by the contractor), and any/all other documentation pertinent to the performance monitoring system. Data shall also include but not be limited to

1. Requirements as provided to subcontractors.

2. Subcontractors response and interpretation of requirements,

3. Test procedures by contractor and subcontractors.

4. Any qualification tests, results, conclusions, observations.

5. Changes as provided by the program office, as initiated by the contractor, as required by the results from new data, as required for any other purposes.

6. All data item requirements.

7. All data necessary for life cycle support, test, certification.

8. Design drawings, source code, program language(s), and other documentation to provide the capability for independent certification, duplication of the system, subsystem, elements, firmware/software, and hardware.

TASK 110 PERFORMANCE MONITORING FAULT IMPACT

110.1 Overview: Not all faults have the same effect on system integrity, system effectiveness, or system operational availability. Some faults mask others that may have more of an impact on system integrity. Similarly, certain portions of systems have redundancies, either natural or planned. In the case of faults in redundant portions, it may be possible to schedule maintenance for some planned time. The faults, then, are not critical to system integrity or operations, provided they are recorded and repaired at the next repair cycle time. When a multitude of faults occur, there are often one or two major faults that have had a ripple effect and cause other faults to occur. The ripple impact is potentially dangerous because the impact on system operation will not be easily determined and the parent fault(s) of the problem may not be identified. By assigning levels of impact to each fault, there is a better probability of correctly assessing the fault impact, determining system impact, and looking for the most damaging fault first.

In effect, giving a level of impact to each fault allows for more correct diagnosis of the actual cause of failures. For example, if a power supply were to be in fault, most of the units that had test points for the performance monitoring subsystem would give indication of failure. For this reason, given the multitude of possible faults occurring or seeming to occur all at once, it is necessary to determine the impact of every test point used for the performance monitoring subsystem. The standard procedure is to give each fault an impact level (sometimes called a priority level).

110.2 Purpose: The purpose of Task 110 is to test the ability of the performance monitoring subsystem to correctly determine the impact of faults that it has detected with respect to the integrity and effectiveness of the major system. Additionally, this task is to demonstrate that faults do not mask each other when they occur at the same time. This task is also to demonstrate that the fault determin- ation will allow formaintenance actions in the required time and to the proper fault isolation group.

110.3 Task Description: A performance monitoring plan for fault impact shall be developed and include but not be limited to

1. A description of how fault impact is handled by the system.

2. A description of how the performance monitoring design meets the PIDS requirements.

3. A test plan and procedure for testing fault impact.

4. A worst-case series of tests and their evaluations regarding which fault created the problem.

5. Test cases intended to be ambiguous with respect to which fault initiated the problem.

6. Stress test cases under actual operating conditions.

7. A listing of test panel indications for all tests.

Documentation of all fault impact test results shall be included in this task.

FAULT DETECTION TASKS

TASK 201 FAULT DETECTION PROGRAM PLAN

201.1 Overview: The Fault Detection Program Plan shall be designed as a basic tool to assist the contractor in implementing an effective fault detection development program. The government will also use the plan to (1) evaluate the contractor's approach to, and his execution of, fault detection tasks, (2) evaluate the adequacy of his procedures for planning, implementing, and controlling the fault detection tasks, and (3) evaluate the ability of his organizational structure to focus on fault detection activities/problems.

201.2 Purpose: The purpose of Task 201 is to develop a Fault Detection Program Plan that identifies and integrates all program tasks necessary to accomplish the requirements of the Prime Item Development Specification (PIDS) and the Statement of Work (SOW).

201.3 Task Description: A Fault Detection Program Plan shall be prepared to provide, as a minimum, the following:

1. A description of how the fault detection program will be conducted to meet the requirements of the PIDS and the SOW.

2. A description of how fault detection design interfaces with total system design.

3. A detailed description of how each specific fault detection requirement will be performed or complied with.

4. The procedures to evaluate the status and control of each task, and identification of the organizational unit with the authority and responsibility for executing each task.

5. A schedule with estimated start and completion points for each fault detection program activity or task.

6. The identification of known fault detection problems to be solved, an assessment of the impact of these problems on meeting specified requirements, and the proposed solutions or proposed plan to solve them.

7. The procedure or methods for recording the status of actions taken to resolve problems.

8. The designation of fault detection milestones, including design, review (PDR, CDR, IPR), and test.

9. The method by which the fault detection requirements are disseminated to designers and associated personnel, and how design interfaces are accomplished.

10. Identification of key personnel for managing the fault detection program and the level of authority for problem resolution.

11. Description of the management structure, including interrelationship between line, service, staff, and policy organizations.

12. The fault detection design review checklist that will be used.

When approved by the Government, the Fault Detection Program Plan shall become, together with the SOW, a basis for evaluation of contractual compliance.

TASK 202 FAULT DETECTION PROGRAM DESIGN REVIEWS

202.1 Overview: Periodic design reviews should be held to establish whether or not the projected design will meet the requirements of the specifications. At the onset, reviews should be held more frequently to ensure that the contractor does not proceed with unsuitable designs. The reviews are also to confirm that the contractor is not only meeting the 'wording' of the specification, but also the intent of the specification. Design reviews may be held at any time and it is not necessary that they be separate from other reviews, providing that they are given proper emphasis as would be required to ensure that the contractor is performing and adhering to Government standards and requirements and also to other sections of this entire specification

202.2 Purpose: The purpose of Task 202 is to establish a requirement for the contractor to conduct formal and informal fault detection program design reviews.

202.3 Task Description: Fault detection formal design reviews shall be conducted in accordance with the requirements of MIL-STD-1521B or a schedule approved by the Government. Informal in-process fault detection reviews shall be conducted at least quarterly until formal CDR on a schedule mutually agreed upon by the Government and the contractor. The contractor-proposed formal and informal design review schedule shall be provided as part of the Fault Detection Program Plan.

In addition to the formal design review requirements of MIL-STD-1521B, the following formal and informal design reviews shall include review of the fault detection items indicated below.

1. Preliminary Design Review (PDR):

   a. Updated fault detection program status including

      1) Fault detection modeling;
      2) Fault detection allocation;
      3) Fault detection predictions;
      4) Fault detection compliance with specifications;
      5) Design guideline criteria.

   b. Problems affecting fault detection.

   c. Fault detection critical items.

2. Critical Design Review (CDR):

   a. Fault detection compliance with specifications.
   b. Fault detection predictions and analyses.
   c. Fault detection critical items.
   d. Problems affecting fault detection.
   e. Identification of circuits where the design requires high reliability components and the software firmware employs an extra-large number of lines of code.

3. In-Process Fault Detection Reviews (IPR):

   a. Discussion of those fault detection items previously listed under Sections a and b.
   b. Results of fault detection test analyses.
   c. Test schedule: start and completion dates.
   d. Fault detection parts, design, reliability, and schedule problems.
   e. Status of assigned action items.
   f. Contractor's assessment of fault detection design effectiveness.
   g. Other topics and issues on the agenda agreed to by the contractor and the Government.
   h. Results of applicable fault detection growth testing.

4. Test Readiness Review:

   a. Fault detection analyses status and primary prediction.
   b. Test schedule.
   c. Test profile.
   d. Test plan including failure definition.
   e. Test report.

5. Production Readiness Review results of applicable fault detection growth testing.

TASK 203 FAULT DETECTION MODELING

203.1 Overview: Both quantitative and qualitative analyses are useful in determining where fault detection resources should be applied. The analyses identify improvements that must be made if requirements are to be met.

In particular, the analyses are efficient work direction tools because they can confirm system adequacy or identify the need for design change, provided they are accomplished in conjunction with, or reviewed by, other disciplines.

203.2 Purpose: The purpose of Task 203 is to develop a fault detection model for making numerical allocations and estimates to evaluate system/subsystem/equipment fault detection effectiveness.

203.3 Task Description: A fault detection mathematical model based on system/subsystem/equipment functions shall be developed and maintained. As the design evolves, a fault detection block diagram (FIG) with associated allocations and predictions for all elements in the FIG shall be created. The fault detection block diagram shall be keyed and traceable to the functional block diagram, schematics, drawings, and specifications. The model outputs shall be expressed in terms of fault detection requirements. As changes occur, the model shall be updated to include hardware or software/firmware design changes.

The fault detection model shall be updated with information resulting from relevant tests and changes in item configuration.

TASK 204 FAULT DETECTION ALLOCATION

204.1 Overview: System fault detection requirements evolve in a number of ways, from informed judgments to analyses based on empirical data. The requirements are designed to minimize the total cost of developing, procuring, and operating the system over its life cycle. The integrity of the system is maintained by adequate top-down design that ensures that the system will meet specified requirements. The specific subsystem requirements must be refined before resources can be specifically allocated for them.

204.2 Purpose: The purpose of Task 204 is to ensure that, once quantitative system requirements have been determined, they are properly allocated or apportioned to lower levels.

204.3 Task Description: Both the mission and mission integrity requirements shall be allocated to the level specified and shall be used to establish the baseline requirements for designers and software/firmware personnel. Requirements consistent with the allocations shall be imposed on all subcontractors and suppliers. The allocated values shall be included in appropriate sections of any procurement specifications, critical item specifications, and contract and item specifications to subcontractors/suppliers. All allocated fault detection values established by the contractor and included in subcontract item specifications shall be consistent with the mathematical model required in Task 203.

TASK 205 FAULT DETECTION PREDICTION

205.1 Overview: Allocations are determined from the system fault detection requirements to provide lower level requirements that are levied on the designers and software/firmware engineers. As design work progresses, predictions (based on previously generated data) and assessments (based on program test data) are used to determine whether or not the allocated requirement can or will be met.

Predictions combine lower level fault detection data to indicate equipment fault detection performance at successively higher levels, from subassemblies through subsystem to system. Predictions falling short of requirements at any level signal the need for management and technical attention.

205.2 Purpose: The purpose of Task 205 is to estimate the fault detection capability of the system, subsystem, equipment, hardware, and software/firmware and to determine whether or not the fault detection requirements can be achieved with the proposed design.

205.3 Task Description: Fault detection predictions shall be made for the system, subsystem, equipment, hardware, and software/firmware. The predictions shall include the probability of not diagnosing a fault and the probability of incorrectly diagnosing a fault.

The predictions shall be made by using the associated fault detection block diagram and fault detection coverage data and shall be approved by the Government. Items and equipment shall not be excluded from the predictions for any reason.

TASK 206 FAULT DETECTION FAULT IDENTIFICATION

206.1 Overview: Faults that are detected must also be correctly identified. In order to perform repair actions, much detail about each fault is required. The particular off-line tests using the fault location function which identify the correct fault isolation group and Line Replacement Unt (LRU) and possibly the failing LRU often require more than one fault location test to be performed. For this reason, all monitored test points that provide fault information to the central PM/FD/FL function must be correctly designed. The information from these test points must be recorded and assimilated into proper groupings,which identify the suitable fault location test to be performed.

206.2 Purpose: The purpose of Task 206 is to verity that proper fault identification, display, and maintenance action codes will be available to maintenance personnel. Verification shall also demonstrate that the identity of any faults detected will be prioritized so that maintenance personnel will perform tests for the more likely fault first. Verification shall show that the correct information specified in the PIDS for each detected fault is correctly provided to and displayed on the maintenance panel.

206.3 Task Description: A fault detection fault identification plan shall be developed and include, but not be limited to

1. A description of how fault identification is handled by the system.

2. A description of how the fault identification design meets PIDS requirements

3. A test plan and procedure for proper fault identification.

4. A worst-case series of tests to show that the most likely fault is displayed first.

5. Test cases intended to be ambiguous with respect to which fault initiated the problem.

6. Stress tests for proper fault identification under actual operating conditions.

TASK 207 FAULT DETECTION FUNCTION CERTIFICATION

207.1 Overview: It is vital that designs be tested not only to see if the designs themselves are functional and fault free but also that the designs meet not only the 'letter of specification' it also meet the actual intent of the specification. Verification of esign to specification should be verified at all levels of de elopment and when it appears to have been completed, retesting and reveri ication should occur, starting at the original design teams, to con tractor quality assurance personnel, to independent test teams, and inally by the Government.

207.2 Purpose: The purpose of this task is to veri y and demonstrate that the design for the fault detection subfunction eets not only the 'letter of the specification' but also meets the int nt of the specification.

207.3 Task Description: Task 207 fault detection unction certification is a series of qualifying tests to det rmine adherence to the PIDS requirements. These tests shall be designe to answer, as a minimum, the following questionsas my be required by the specifications:

1. Did the fault detection function detect th fault?

2. Did fault detection provide effective faul isolation information for corrective maintenance act ons?

3. Did fault detection provide information fo further tests which could confirm the problem?

4. Did the fault detection function provide i formation regarding the impact of the fault to the s stem?

5. What was the latency time between the occu rence of the fault and the final indication on the pane ?

6. Was there any ambiguity surrounding the fa lt or the correction?

7. What are the total number of undetected fa lts in any given period? Why were they not detected?

8. What is the latency time from software/har ware failure to automatic rebooting?

9. What is the latency time to detect a prob n in the computer firmware/hardware that is not cor ectable by automatic rebooting?

TASK 208 FAULT DETECTION INDEPENDENT VERIFICATION AND VALIDATION

208.1 Overview: Independent fault detection verification and validation performed by a scientific team not involved in the design, development, and tests ensures that the fault detection design meets the PIDS requirements. The IV&V team will ensure that the fault detection subprogram will not fail and will perform up to its intended capacity.

208.2 Purpose: The purpose of Task 208 is to independently determine that the PIDS and SOW requirements have been met.

208.3 Task Description: Procedures shall be independently established, maintained, and implemented, to be performed by test and analysis, to verify and validate the ability of the fault detection subsystem to meet all of the requirements of the PIDS and SOW. The functional testing of the design shall employ methodologies of great stress and strain to the hardware and firmware/software. The fault detection subsystem shall be tested under worst-case actual operational conditions. The documentation produced by the independent IV&V team shall include, but not be limited to

1. The test plan for the tests which will be conducted, including the operational conditions under which they will be performed.

2. The actual test procedures with dates, test engineer, location, and all other pertinent information.

3. Identification, description, listings, and source code for IV&V test programs.

4. Complete test reports, results, deficiencies, problems, and observations.

TASK 209 FAULT DETECTION CONFIGURATION MANAGEMENT

209.1 Overview: Separate plans and procedures shall be prepared and adopted for the collecting, cataloging, describing, of all designs, changes, implementations, problems, programs, test procedures, test results, test findings, conclusions, and observations for the fault detection program, subprogram, elements, hardware firmware/software.

209.2 Purpose: The purpose of this task is to verify and demonstrate the configuration management specifications, detail, quantity, quality, and media are sufficient to meet the requirements for the program.

209.3 Task Description: The contractor shall use a configuration management program for the fault detection system, subsystem, program elements, hardware, software/firmware, ECPs, PDRs, listings of PIDs requirements (as interpreted by the contractor), and any/all other documentation pertinent to the fault detection system. Data shall also include but not be limited to

1. Requirements as provided to subcontractors.

2. Subcontractors response and interpretation of requirements,

3. Test procedures by contractor, and subcontractors.

4. Any qualification tests, results, conclusions, and/or observations.

5. Changes as provided by the program office, as initiated by the contractor, as required by the results from new data, as required for any other purposes.

6. All data item requirements.

7. All data necessary for life cycle support, test certification.

8. Design drawings, source code, program language(s), and other documentation to provide the capability for independent certification, duplication of the system, subsystem, elements, firmware/software, and hardware.

TASK 210 FAULT DETECTION FAULT IMPACT

210.1 Overview: Not all faults have the same effect on system integrity, system effectiveness, or system operational availability. Some faults mask other faults that may have more of an impact on system integrity. Similarly, certain portions of systems have redundancies, either natural or planned. In the case of faults in redundant portions, it may be possible to schedule maintenance for some planned time. The faults, then, are not critical at that time to system integrity or operations, provided they are recorded and repaired at the next repair cycle time. When a multitude of faults occurs, there are often one or two major faults which have had a ripple effect and cause other faults to occur. The ripple effect is potentially dangerous because the impact on system operation will not be easily determined and the parent fault(s) of the problem may not be identified. By assigning levels of impact to each fault, there is a better probability of correctly assessing the fault impact, determining system impact, and looking for the most damaging fault first.

In effect, giving a level of impact to each fault allows for more correct diagnosis of the actual cause of failures. For example, if a power supply were to be at fault, most of the units that had test points for the fault detection subsystem would give indication of failure. For this reason, given the multitude of possible faults occurring or seeming to occur all at once, it is necessary to determine the impact of every test point utilized for the fault detection subsystem. The standard procedure is to give each fault an impact level (sometimes called a priority level).

210.2 Purpose: The purpose of Task 207 is to test the ability of the fault detection subsystem to correctly identify faults it has detected and to correctly determine the impact of those faults with respect to the integrity and effectiveness of the major system. Additionally, the task is to demonstrate that faults do not mask each other when they occur at the same time.

210.3 Task Description: A fault detection plan for fault impact shall be developed and shall include but not be limited to

1. A description of how the fault detection design meets the PIDS requirements with respect to fault impact.

2. A description of how fault impact is handled by the system.

3. A description of the assignment of priority to faults with respect to fault impact.

4. A test plan and procedure for testing fault detection and fault impact.

5. A worst-case series of tests and their evaluations.

6. Test cases intended to be ambiguous with respect to which fault initiated the problem.

7. Stress test cases under actual operating conditions.

8. A listing of test panel indications for all above tests.

Documentation for all fault impact test results shall be included in this task.

TASK 211 FAULT DETECTION FUNCTION TRANSIENT SMOOTHING

211.1 Overview: Electronic systems, especially those that have long distances between units, are susceptible to all kinds of interference, including DC offsets, ground loops, EMI, and noise bursts and pulses caused by other electronic devices. The devices themselves may also cause transients when certain combinations of operations are performed. Therefore, a simple pass/fail test at any test point may show indication of a fault when, in fact, there is none. Similarly, a fault finding may be lost or erroneously modified during transmission from one system component to another. Transient smoothing is, therefore, required to reduce the number of false fault indications. It is also imperative that certain test points which are critical to system integrity have their responses quickly read. All test points should be able to report within given latency times even if anomalies exist somewhere in the subsystem.

211.2 Purpose: The purpose of Task 211 is to ensure the ability of the fault detection subsystem to

1. Report all faults within the specified latency time, regardless of anomalies, either at the test point or during transmission from one point to another.

2. Report the condition of any test point that has become inoperative or incommunicative.

3. Not report non-recurring faults, glitches, or transients.

211.3 Task Description: A Fault Detection Transient Smoothing Plan for design, test, certification, and verification shall be developed and implemented. The plan shall include but not be limited to

1. A description of how each fault is handled to avoid false alarms.

2. A description of verification/validation test plans for transient smoothing.

3. A description of verification of tests to be performed under worst-case actual operating conditions or equivalent.

4. A description of the verification test that ensures the reporting of faults within the time specified in the PIDS.

A report on the implementation of this plan, including test findings, shall be included in all design reviews.

FAULT LOCALIZATION TASKS

TASK 301 FAULT LOCALIZATION PROGRAM PLAN

301.1 Overview: The Fault Localization Program Plan shall be designed as a basic tool to assist the contractor in implementing a fault localization development program. The Government will also use the plan to (1) evaluate the contractor's approach to, and his execution of, fault localization tasks (2) evaluate the adequacy of his procedures for planning, implementing, and controlling the fault localization tasks and (3) evaluate the ability of his organizational structure to focus on fault location activities/ problems.

301.2 Purpose: The purpose of Task 301 is to develop a Fault Localization Program Plan that identifies and integrates all program tasks necessary to accomplish fault localization requirements of the Prime Item Development Specification (PIDS) and the Statement of Work (SOW).

301.3 Task Description: A fault localization Program Plan shall be prepared to provide, as a minimum, the following:

1. A description of how the fault localization program will be conducted to meet the requirements of the PIDS and the SOW.

2. A description of how fault localization design interfaces with total system design.

3. A detailed description of how each specific fault localization requirement will be performed or complied with.

4. The procedures to evaluate the status and control of each task, and identification of the organizational unit with the authority and responsibility for executing each task.

5. A schedule with estimated start and completion points for each fault localization program activity or task.

6. The identification of known fault localization problems to be solved, an assessment of the impact of these problems on meeting specified requirements, and the proposed solutions or proposed plan to solve them.

7. The procedure or methods for recording the status of actions to resolve problems.

8. The designation of fault localization milestones, including design review (PDR, CDR, IPR) and test.

9. The method by which the fault localization requirements are disseminated to designers and associated personnel and how design interfaces are accomplished.

10. Identification of key personnel for managing the fault localization program and the level of authority for problem resolution.

11. Description of the management structure, including interrelationship between line, service, staff, and policy organizations.

12. The fault localization design review checklist that will be used to ensure that the design meets requirements.

When approved by the Government, the fault localization Program Plan shall become a basis for evaluation of contractual compliance.

TASK 302 FAULT LOCALIZATION PROGRAM DESIGN REVIEWS

302.1 Overview: Periodic design reviews should be held to establish whether or not the projected design will meet the requirements of the specifications. At the onset, reviews should be held more frequently to ensure that the contractor does not proceed with unsuitable designs. The reviews are also to confirm that the contractor is not only meeting the 'wording' of the specification, but also the intent of the specification. Design reviews may be held at any time, and it is not necessary that they be separate from other reviews, providing that they are given proper emphasis as would be required to ensure that the contractor is performing and adhering to Government standards and requirements and also to other sections of this entire specification.

302.2 Purpose: The purpose of Task 302 is to establish a requirement for the contractor to conduct formal and informal fault localization program design reviews.

302.2 Task Description: Fault localization formal design reviews shall be conducted in accordance with the requirements of MIL-STD-1521B on a schedule approved by the Government. Informal fault localization in-process reviews shall be conducted at least quarterly until formal CDR on a schedule mutually agreed upon by the government and the contractor. The contractor-proposed formal and informal design review schedule shall be provided as part of the fault localization Program Plan.

In addition to the formal design review requirements of MIL-STD-1521B, the following formal and informal design reviews shall include the fault localization requirements indicated below:

1. Preliminary Design Review (PDR):

   a. Updated fault localization program status, including
      1) fault localization modeling;
      2) fault localization allocation;
      3) fault localization predictions;
      4) fault localization compliance with specifications;
      5) design guideline criteria.

   b. Problems affecting fault localization.

   c. Fault localization critical items.

2. Critical Design Review (CDR):

   a. Fault localization compliance with specifications.

   b. Fault localization predictions and analyses.

   c. Fault localization critical items.

   d. Problems affecting fault localization.

   e. Identification of circuits where the design requires high reliability components and the software/ firmware employs an extra-large number of lines of code.

3. In-Process Fault Localization Reviews (IPR):

   a. Discussion of those fault localization items previously listed under Sections a and b.

   b. Results of fault localization test analyses.

   c. Test schedule: start and completion dates.

d. Fault localization parts, design, reliability, and schedule problems.

e. Status of assigned action items.

f. Contractor's assessment of fault localization design effectiveness.

g. Other topics and issues on the agenda agreed to by the contractor and the Government.

h. Results of applicable fault localization growth testing.

4. Test Readiness Review:

a. Fault Localization analyses status and primary prediction.

b. Test schedule.

c. Test profile.

d. Test plan including failure definition.

e. Test report.

5. Production Readiness Review: Results of applicable fault localization growth testing.

TASK 303 FAULT LOCALIZATION MODELING

303.1 Overview: Both quantitative and qualitative analyses are useful in determining where fault localization resources should be applied. The analyses identify improvements that must be made if requirements are to be met.

In particular, the analyses are efficient work direction tools because they can confirm system adequacy or identify the need for design change, provided they are accomplished in conjunction with, or reviewed by, other disciplines.

303.2 Purpose: The purpose of Task 303 is to develop a fault localization model for making numerical allocations and estimates to evaluate system/subsystem/equipment fault localization effectiveness.

303.3 Task Description: A fault localization mathematical model based on system/subsystem/equipment functions shall be developed and maintained. As the design evolves, a fault localization block diagram (fault isolation groupings) with associated allocations and predictions for all elements in the FIG shall be created. The fault localization block diagram shall be keyed and traceable to the functional block diagram, schematics, drawings, and specifications. The model outputs shall be expressed in terms of fault localization requirements. As changes occur, the model shall be updated to include hardware or software/firmware design changes.

The fault localization model shall be updated with information resulting from relevant tests and changes in item configuration.

TASK 304 FAULT LOCALIZATION ALLOCATION

304.1 Overview: System fault localization requirements evolve in a number of ways, from informed judgments to analysis based on empirical data. The requirements are designed to minimize the total cost of developing, procuring, and operating the system over its life cycle. The integrity of the system is maintained by adequate top-down design that ensures the ability of the system to meet specified requirements. The specific subsystem requirements must be refined before resources can be specifically allocated for them.

304.2 Purpose: The purpose of Task 304 is to ensure that, once quantitative system requirements have been determined, they are allocated or apportioned to lower levels.

304.3 Task Description: Both the mission and mission integrity requirements shall be allocated to the level specified and shall be used to establish the baseline requirements for designers and software/firmware personnel. Requirements consistent with the allocations shall be imposed on all subcontractors and suppliers. The allocated values shall be included in appropriate sections of any procurement specifications, critical item specifications, and contract end item specifications to subcontractors/suppliers.

The allocated values shall be included in appropriate sections of any procurement specifications, critical item specifications, and contract end item specifications to subcontractors/suppliers. All allocated fault localization values established by the contractor and included in subcontract item specifications shall be consistent with the mathematical model required in Task 303.

TASK 305 FAULT LOCALIZATION PREDICTION

305.1 Overview: Allocations are determined from the system fault localization requirements to provide lower level requirements that are levied on the designers and software/firmware engineers. As design work progresses, predictions (based on previously generated data) and assessments (based on program test data) are used to determine whether or not the allocated requirement can or will be met.

Predictions combine lower level fault localization data to indicate equipment fault localization performance at successively higher levels, from subassemblies through subsystem to system. Predictions falling short of requirements at any level signal the need for management and technical attention.

305.2 Purpose: The purpose of Task 305 is to estimate the fault location capability of the system, subsystem, equipment, hardware, and software/firmware and to determine whether or not the fault localization requirements can be achieved with the proposed design.

305.3 Task Description: Fault localization predictions shall be made for the system, subsystem, equipment, hardware, and software/firmware. The predictions shall include (1) the probability of not localizing the fault; (2) the probability of localizing a fault to the incorrect fault isolation group; and (3) the probability of localizing a fault to within the correct fault isolation group.

The predictions shall be made by using the associated fault localization block diagram and fault localization coverage data and shall be approved by the Government. Items and equipment shall not be excluded from the prediction for any reason.

TASK 306 FAULT LOCALIZATION FAULT IDENTIFICATION

306.1 Overview: Many faults cause domino effects where the occurrence of one fault causes additional other fault indications. In order to provide effective repair, in minimum time, and also to evaluate the impact on the system caused by the root fault, it is necessary that the root fault be determined and found. The design of the fault localization subsystem must be of sufficient complexity to isolate the root fault despite the occurrence of multiple faults and other ambiguities.

306.2 Purpose: The purpose of Task 306 is to test the ability of the fault localization subsystem to detect and correctly identify faults.

306.3 Task Description: A fault localization plan for fault identification shall be developed that includes but is not limited to

1. A description of how fault identification is handled by the system.

2. A description of how the fault localization design meets the PIDS requirements.

3. A test plan and procedure for testing fault identification.

4. A worst-case series of tests and their evaluations.

5. Test cases intended to be ambiguous with respect to which fault initiated the problem.

6. Stress test cases under actual operating conditions.

7. A listing of the test panel indications for all above tests.

Documentation of all fault localization test results shall be included in this task.

TASK 307 FAULT LOCALIZATION FUNCTION CERTIFICATION

307.1 Overview: It is vital that designs be tested, not only to see if the designs themselves are functional and fault free, but also that the designs meet not only the 'letter of the specification' but also meet the actual intent of the specification. Verification of design to specification should be verified at all levels of development and when it appears to have been completed, retesting and verification should occur, starting at the original design team, to contractor quality assurance personnel, to independent test teams, and finally by the Government.

307.2 Task Description: Task 307 Fault localization function certification is a series of qualifying tests to determine adherence to the PIDS requirements. These tests shall be designed to answer, as a minimum, the following questions:

1. Did the fault localization function detect the fault?

2. Did fault localization provide effective fault isolation information for corrective maintenance actions?

3. Did fault localization provide information for further tests that could confirm the problem?

4. Was there any ambiguity surrounding the fault or the correction?

5. Were there any unlocalized faults? Why were they not localized?

TASK 308 FAULT LOCALIZATION INDEPENDENT VERIFICATION & VALIDATION

308.1 Overview: Independent fault localization verification and validation performed by a scientific team not involved in the design, development, and tests ensures that the fault localization design meets the PIDS requirements. The IV&V team will ensure that the fault localization subprogram will not fail and will perform up to its intended capacity.

308.2 Purpose: The purpose of Task 308 is to independently determine that the PIDS and the SOW requirements have been met.

308.3 Task Description: Procedures shall be independently established, maintained, and implemented, to be performed by test and analysis, to verify and validate the ability of the fault localization subsystem to meet all requirements of the PIDS and SOW.

The fault localization subsystem shall be tested under worst-case actual operational conditions. The documentation produced by the IV&V team shall include but not be limited to

1. The test plan for the tests which will be conducted, including the operational conditions under which they will be performed.

2. The actual test procedures with dates, test engineer, location, and all other pertinent information.

3. Identification, description, listings, and source code for IV&V test programs are used.

d. Complete test reports, results, deficiencies, problems, and observations.

TASK 309 FAULT LOCALIZATION CONFIGURATION MANAGEMENT OVERVIEW:

309.1 Overview: Separate plans and procedures shall be prepared and adopted for the collecting, cataloging, and describing of all designs, changes, implementations, problems, programs, test procedures, test results, test findings, conclusions, observations, for the fault localization program, subprogram, elements, hardware firmware/software.

309.2 Purpose: The purpose of this task is to verify and demonstrate the configuration management specifications, detail, quantity, quality, and media are sufficient to meet the requirements for the program.

309.3 Task Description: The contractor shall use a configuration management program for the fault localization system, subsystem, program elements, hardware, software/firmware, ECPs, PDRs, listings of PIDs requirements (as interpreted by the contractor), any/all other documentation pertinent to the fault localization system. Data shall also include, but not be limited to:

1. Requirements as provided to subcontractors.

2. Subcontractors response and interpretation of requirements.

3. Contractor and subcontractors test procedures.

4. Any qualification tests, results, conclusions, and/or observations.

5. Any changes as provided by the program office, as initiated by the contractor, as required by the results from new data, as required for any other purposes.

6. All data item requirements.

7. All data necessary for life cycle support, test, and certification.

8. Design drawings, source code, program language(s), and other documentation used to provide the capability for independent certification, duplication of the system, subsystem, elements, firmware/software, and hardware.

CONCLUSIONS/SUMMARY:

The continuing increase in complexity of military systems has imposed additional maintenance and logistic burdens on our operating forces. As these organizations experience a reduction of both manning and skill levels the requirements for quick equipment malfunction repair has risen. Experience has indicated that when systems become fully operational, a number of problems are likely to occur and that these problems must be dealt with in an orderly, precise and cost effective manner. As a system matures, problems still exist and all but the simplest will pose insurmountable difficulties to the test and repair technician(s). Also, because major turnovers in experienced personnel is a fact that cannot be dismissed, automated performance monitoring, fault detection and fault localization for sustaining day-to-day support of a system must be accomplished by the user organization, namely our operating fleet. The report presented herein, therefore, presents a method of developing performance and maintenance aid design techniques that enables the system to localize faults to a manageable number of units. The technique shown provides a record of the design elements requisite to best design practices and provides a systematic approach to the PM/FD/FL process not previously provided in contract or SOW requirements. Incorporation of this document and/or portions thereof into system SOW documentation will allow relevant subject areas to be addressed and judgements of conformity to requirements can be more readily made by the reviewing agency.

The specification as described herein has been successfully applied to a Navy sponsored program. Elements, as developed, were collected and combined resulting in the subject document for the purpose of future application in programs requiring PM/FD/FL design/development.

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APPENDIX A

STATEMENT OF WORK SAMPLES

PERFORMANCE MONITORING, FAULT DETECTION, FAULT LOCALIZATION REQUIREMENTS

1.0 Performance Monitoring, Fault Detection, Fault Localization Program.

The contractor shall develop and implement a PM/FD/FL program in accordance with the statement of work (SOW) and the tailored requirements of the applicable PIDS, and where applicable pertinent sections of MIL-STD-785B, MIL-STD-470A, MIL-STD-2167A.

1.1 PERFORMANCE MONITORING

a. Task 101 Performance Monitoring Program Plan.

b. Task 102 Performance Monitoring Program Design Reviews.

c. Task 103 Performance Monitoring Modeling.

d. Task 104 Performance Monitoring Allocation.

e. Task 105 Performance Monitoring Prediction.

f. Task 106 Performance Monitoring Fault Tree.

g. Task 107 Performance Monitoring Function Certification.

h. Task 108 Performance Monitoring Independent IV&V.

i. Task 109 Performance Monitoring Configuration Management.

j. Task 110 Performance Monitoring Fault Impact.

1.2 FAULT DETECTION

a. Task 201 Fault Detection Program Plan.

b. Task 202 Fault Detection Program Design Reviews.

c. Task 203 Fault Detection Modeling.

d. Task 204 Fault Detection Allocation.

e. Task 205 Fault Detection Prediction.

f. Task 206 Fault Detection Fault Identification.

g. Task 207 Fault Detection Function Certification.

h. Task 208 Fault Detection Independent 1V&V.

i. Task 209 Fault Detection Configuration Management.

j. Task 210 Fault Detection Fault Impact.

k. Task 211 Fault Detection Function Transient Smoothing

1.3 FAULT LOCALIZATION

a. Task 301 Fault Localization Program Plan.

b. Task 302 Fault Localization Design Reviews.

c. Task 303 Fault Localization Modeling.

d. Task 304 Fault Localization Allocation.

e. Task 305 Fault Localization Prediction.

f. Task 306 Fault Localization Fault Identification.

g. Task 307 Fault Localization Function Certification

h. Task 308 Fault Localization Independent 1V&V.

i. Task 309 Fault Localization Configuration Management.

1.0 SCOPE

1.1 PURPOSE

This appendix to the SOW specifies the requirements to be applied during the development and certification of the PM/FD/FL subsystem.

1.2 ADHERENCE TO MIL STANDARDS

The software and firmware portions of PM/FD/FL shall be developed, verified, validated, and certified as described in the SOW. For purposes of legality, configuration, and where else applicable the software/firmware developed for PM/FD/FL shall be considered to be 'tactical' software/firmware.

The hardware portions of PM/FD/FL shall adhere to Appendix B of the SOW and conform and be certified to all requirements as stated.

1.2 SPECIAL REQUIREMENTS FOR PM/FD/FL

The system shall utilize the PM/FD/FL subsystem for the maintenance demonstration. The PM/FD/FL shall be certified and accepted prior to the maintenance demo.

The software/firmware portions of the system shall conform to reliability growth methodology in that progressive builds, threads, strings shall indicate the ability of the PM/FD/FL subsystem to meet PIDS requirements throughout the test, and certification programs and also conform to life cycle requirements as stated in the PIDS, type-A specifications, SOW and all appendices, and the contract.

1.3 PM/FD/FL DEFAULT CONDITIONS

The PM/FD/FL subsystem shall conform to PIDS requirements for the automatic rebooting of software, programs, parameters, executives, and all other operational functions. The PM/FD/FL demonstration during both the software/firmware demo and the PM/FD/FL demo shall provide adequate testing, certification and validation to indicate that the automatic reboot design meets PIDs requirements.

The default for power failure, or failure of the PM/FD/FL to perform as required shall cause a system failure indication or alarm on all panels of the system. Development of the PM/FD/FL subsystem shall require indication that power failure, either accidental or willful, shall cause an immediate failure indication condition.

APPENDIX B
GLOSSARY OF TERMS

Enhanced PM/FD	Additional software and/or hardware to improve the probability of detecting faults.
Fault Detection	That specific subfunction that detects faults (Separate or combined with the performance monitoring subfunction). Usually employs white-box methodologies where specific test points are selected that should give indication as to the condition of the electronic unit under test. Some fault detection test points are naturally occurring in design, others are specifically planned. Problems detected by the fault detection subfunction may or may not be the basis of determining system failure, depending upon the system failure specifications.
Fault Impact	A measurement of the effect on performance caused by a fault.
Fault Isolation Group	That group of modules to which a fault is isolated.
Imminent Failure	Those conditions that are likely to cause functional failures if a maintenance action is not performed.
Latency Time	That amount of time required to identify and detect a fault.
Monitored Fault	Any fault that will cause measurable degradation in performance of any function within the system.
Non-invasive	No measurable affect on system performance.
Performance Monitoring	That subfunction that treats functions, subfunctions and/or entire electronic units as testable entities to be observed (tested). Known and quantified inputs are injected into the entities being tested and the entities' response to those inputs is observed for purposes of determining the integrity of the entity under test.
PM/FD/FL Methodologies	Those designs that are in support of PM/FD/FL requirements.

Structured Methodology	That design which divides functions into separate sub-functions that may be designed/tested/measured separately.
Fault Localization	That function which further isolates faults found by the performance monitoring function and/or fault detection function, down to a Fault Isolation Group (FIG) to allow for a maintenance action. Usually employs more comprehensive tests and provides greater fault isolation than the performance monitoring or fault detection. Usually performed while the system or particular function under test, is off line as the tests are usually invasive and normal operation of the unit under test would not be possible. That function which performs extensive tests to find faults or to test if a maintenance action has eliminated the cause(s) of faults.
System Integrity	That state of readiness where all functions and all monitored points indicate that the functions meet all performance requirements and that no faults exist.
White-box Methodology	That design which states that by dividing a system into separate blocks, the individual blocks will have internal test points that will adequately provide a statement as to the block's integrity.
Black-box Methodology	That methodology which treats entire entities or portions of electronic units as testable entities to be observed (tested). Known and quantified inputs are injected into the entities being tested and the entities response to those inputs is observed for purposes of determining the integrity of the entity under test.

APPENDIX C

PM/FD/FL SAMPLE PRESENTATION SLIDES

PM/FD/FL

ARE METHODS OF ENSURING SYSTEM INTEGRITY AND CONSISTANCY TO ELIMINATE THE NEED FOR THE OPERATOR TO MAKE VALUE JUDGMENTS.

THE SYSTEM INTEGRITY IS NOT DETERMINED BY THE OPERATORS' MOTIVATION, TRAINING, OR ABILITY.

THE SYSTEM INTEGRITY IS DETERMINED BY THE DESIGN OF THE PM/FD/FL SYSTEM

THE DESIGN AND REPEATABILITY OF THE PM/FD/FL SYSTEM SHOULD BE GIVEN HIGH PRIORITY.

WHY ALL THE FUSS ABOUT PM/FD/FL??

BECAUSE IT IS A FIRST STEP TOWARDS PROVIDING NON-STOP ELECTRONIC SYSTEMS.

TODAY MORE AND MORE ELECTRONIC SYSTEMS MUST HAVE A HIGH CONFIDENCE LEVEL.

TODAY'S HIGHLY SOPHISTICATED ELECTRONIC SYSTEMS ARE SO COMPLEX THAT NO ONE INDIVIDUAL COULD BE EXPECTED TO KNOW THE ENTIRE SYSTEM.

IF A SYSTEM IS FREE FROM ERROR 98% OF THE TIME AND YOU GET A RESPONSE, HOW DO YOU KNOW IF THE RESPONSE IS CORRECT OR IN THE 2% ERROR MARGIN?

AT PRESENT PM/FD/FL IS NOT A PANACEA BUT IT IS AN APPROACH TOWARD IMPROVEMENT OF CONFIDENCE LEVELS AND RESPONSE INTEGRITY.

IT IS TRULY A THIRD GENERATION APPROACH TO COMPUTER RELIABILITY.

PM/FD/FL IMPLIES ON-LINE OPERATION

I.E.

THE CYCLIC RATE OF PM/FD/FL TESTING IS CONSTRAINED BY THE

COMPUTER ARCHITECTURE

LOGIC DESIGN

RESIDENT EXECUTIVE OPERATING SYSTEM

SOFTWARE LANGUAGE

SOFTWARE SPEED REQUIREMENTS

IDEALLY THE PM/FD/FL SYSTEM SHOULD BE RUN AS NON-INVASIVE AS POSSIBLE. EVEN WHERE THIS IS NOT POSSIBLE, IT SHOULD RUN ON ALGORITHM PREDETERMINED NOT BY AN OPERATOR, BUT RATHER BASED UPON THE PRIORITY NEEDS OF EACH OF THE SUB-SYSTEMS WHICH MAKE UP THE TOTAL SYSTEM.

PM/FD/FL

- STOPPING THE NORMAL RUNNING SYSTEM FOR AN ADVANCED PM/FD/FL CHECK SHOULD BE POSSIBLE; BUT THE MORE MANUAL THE METHOD, THE LESS EFFECTIVE THE DESIGN PHILOSOPHY OF PM/FD/FL.

- THE WHOLE DESIGN CRITERIA FOR PM/FD/FL IS TO ALLOW FOR CONSISTANCY IN COMPUTER INTEGRITY SANS THE COMPUTER/TERMINAL OPERATOR.

PERFORMANCE MONITORING

PERFORMANCE MONITORING IS PROBABLY THE LEAST UNDERSTOOD AND MOST MIS-USED SUBSYSTEM OF PM/FD/FL.

- O THE PM SUBSYSTEM IS NOT THE SAME AS THE FAULT DETECTION SUBSYSTEM.
- O PM IS NOT THE CONVERSE OF FAULT DETECTION; I.E. FAILURE TO DETECT A FAULT IS NOT PRIMA FACIE EVIDENCE THAT THE PERFORMANCE MONITORING SYSTEM IS WORKING CORRECTLY.
- O PERFORMANCE MONITORING IS A MACRO MEASUREMENT OF THE HEALTH OF THE SYSTEM.
- O PERFORMANCE MONITORING IS TO DETERMINE SYSTEM INTEGRITY BY TREATING THE ENTIRE SYSTEM AS A "BLACK BOX" IN THAT PREDETERMINED INPUTS SHOULD GIVE CALCULATABLE OUTPUTS.

PERFORMANCE MONITORING (CONTINUED)

O PERFORMANCE MONITORING IS NECESSARY BECAUSE:

1. TOLERANCES OF SUBSYSTEMS WITHIN THE LARGER SYSTEM COULD BE WITHIN THEIR INDIVIDUAL ACCEPTABLE TOLERANCES YET THOSE TOLERANCES CAN ADD UP IN SUCH A WAY AS TO DEGRADE THE MAJOR SYSTEM.
2. THE FAULT DETECTION SYSTEM, IN A PRACTICAL SENSE, CANNOT TEST EVERYTHING.
3. TRENDS AND TENDENCIES TO AN EVENTUAL FAILURE WOULD LIKELY SHOW UP FIRST AS A PERFORMANCE MONITORING.
4. THE "WHOLE" IS GREATER THAN THE SUM OF ITS PARTS.

PERFORMANCE MONITORING (CONTINUED)

- PERFORMANCE MONITORING SHOULD:

  NOT BE UNDER OPERATOR CONTROL.

  BE RUN INDEPENDENTLY AS AN INTERACTIVE PROCESS WHERE NECESSARY

  BE RUN AS A CONCURRENT PROCESS IF AT ALL POSSIBLE.

  BE RUNNING AT ALL TIMES WHEN THE SYSTEM IS POWERED UP AND INITIALIZED.

- THE OPERATOR SHOULD BE INFORMED AS TO THE PERFORMANCE OF THE SYSTEM (E.G., "ALL MONITORED SYSTEMS AND DATA IN THE PM SYSTEM ARE SATISFACTORY AT THIS TIME").

FAULT DETECTION

THE FD PART OF PM/FD/FL

THE PURPOSE OF FAULT DETECTION IS TO DETECT FAULTS THAT OCCUR IN A SYSTEM. THE DETECTION PROCESS IS USUALLY DESIGNED USING THE "WHITE BOX" METHOD. IN OTHER WORDS, EACH MODULE WITHIN A SYSTEM, IS SCRUTINIZED IN ORDER TO DECIDE WHAT CRITERIA (PECULIAR, PROBABLY, ONLY TO THAT MODULE) WOULD BEST ENSURE RELIABLE FAULT MONITORING.

FAULT

A FAULT IS WHEN:

+ ANY PORTION OF EQUIPMENT, OR PROGRAM DOES NOT PERFORM AS COULD REASONABLY BE EXPECTED.
+ A FAULT MAY OR MAY NOT BE DETECTABLE.
+ A FAULT MAY OR MAY NOT RESULT IN SYSTEM FAILURE
+ A FAULT OCCURS WHENEVER ANYTHING DOESN'T WORK.
+ FAULT DETECTION IS CONSIDERED PART OF THE "FD" SUBSYSTEM, AND, ALTHOUGH THERE IS A RELATION TO THE PERFORMANCE MONITORING SUB-SYSTEM, IT IS SEPERATE BY DESIGN, BY PLAN, AND BY OBJECTIVE.

FAULTS ARE USUALLY CLASSIFIED AS TO MAJOR (FATAL AND UNRECOVERABLE), MINOR (WILL ONLY DEGRADE PERFORMANCE) AND RECOVERABLE (SYSTEM WILL STILL FUNCTION AS PLANNED AFTER SOME ACTION TAKES PLACE).

FAULT DETECTION DESIRABLY SHOULD BE ON-LINE AT ALL TIMES. THAT IS, THE FAULT DETECTION SYSTEM SHOULD RUN CONTINUOUSLY ON ITS OWN WITHOUT OPERATOR INTERVENTION.

FAULT DETECTION THEN IS FREE FROM OPERATOR ABILITY AND ITS INTEGRITY IS DETERMINED BY THE DESIGN PHILOSOPHY.

PM/FD/FL PHILOSOPHY

- FD IS PERFORMED AUTOMATICALLY ON-LINE AND PROVIDES SUPPORT FOR ISOLATION OF FAULTS TO A UNIT LEVEL.
- FD IS ALSO PERFORMED ON A SCHEDULED OFF-LINE BASIS.
- FL IS PARTIALLY PERFORMED BY ON-LINE FD.

APPENDIX D

APPLICABLE DIDS

FOR TASKS

ESTABLISHING PM/FD/FL CONTRACTURAL REQUIREMENTS
TABLE 1
COMPARISON OF PM/FD/FL PROGRAM TASKS
PM/FD/FL CDRL REQUIREMENTS

	PROGRAM			
	PM	FD	FL	DATA ITEM DESCRIPTION (DID)
PROGRAM PLAN	101	201	301	DI-ATTS-8005
DESIGN REVIEWS	102	202	302	DI-E-5423
MODELING	103	203	303	DI-R-7106
ALLOCATION	104	204	304	DI-R-7101
PREDICTION	105	205	305	DI-R-7108
FAULT TREE	106			DI-MISC-80048
FAULT IDENTIFICATION		206	306	DI-MISC-80048
FAULT CERTIFICATION	107	207	307	UDI-T-23732B
INDEPENDENT VERIFICATION/ VALIDATION	108	208	308	UDI-T-23732B
CONFIGURATION MANAGEMENT	109	209	309	DI-E-3108
FAULT IMPACT	110	210		DI-MISC-80048
TRANSIENT SMOOTHING		211		DI-MISC-80048

Also included for possible use are

DI-R-7105 DATA COLLECTION

DI-T-7198 TESTABILITY PROGRAM PLAN

DI-T-7199 TESTABILITY ANALYSIS REPORT

DI-ATTS-XXA (TAILORED) PM/FD/FL MODELING REPORT

DI-ATTS-XXXB (TAILORED) PM/FD/FL ALLOCATION REPORT

DI-ATTS-XXXC (TAILORED) PM/FD/FL PREDICTION REPORT

DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30 1986

1. TITLE	2. IDENTIFICATION NUMBER
HARDWARE DIAGNOSTIC TEST SYSTEM DEVELOPMENT PLAN	DI-ATTS-80005

3. DESCRIPTION/PURPOSE

3.1 The Hardware Diagnostic Test System (HDTS) Development Plan describes the contractor's plan for developing and integrating a hardware fault diagnostic and test capability for system/subsystem/equipment. It provides a controlled statement of the contractor's plan for producing and developing the diagnostic software and hardware diagnostic test devices which satisfy the functional, performance, and

4. APPROVAL DATE (YYMMDD)	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC REQUIRED	6b. GIDEP REQUIRED
850610	G/T213		

7. APPLICATION/INTERRELATIONSHIP

7.1 The Hardware Diagnostic Test System Development Plan provides the contractor with the means to coordinate, control, and monitor progress of the development effort. It provides the Government with knowledge of the schedule, organization and resource allocation planned by the contractor. It is a basic tool with which the Government can monitor the contract work effort.

7.2 This data item description (DID) satisfies the requirements of paragraph 5.1, DOD-STD-1701(NS)

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER
		G3611

10. PREPARATION INSTRUCTIONS

10.1 Source document. This applicable issue of the document cited herein, including its approval date and dates of any applicable amendments and revisions, shall be as reflected in the contract.

10.2 The HDTS development plan shall consist of ten sections with appropriate subsections. The format shall be as follows.

Section I - Introduction

Section II - Organization and Responsibility

Section III - Management and Technical Controls

Section IV - Resources
- 4.1 Personnel
- 4.2 Training
- 4.3 Data Processing Equipment

Section V - Software Development Schedule

3. DESCRIPTION/PURPOSE (Cont'd)

operational requirements of the system/subsystem/equipment. It is used to approve the contractor's approach for a Hardware Diagnostic Test System (HDTS), and to monitor and evaluate the contractor's progress while developing the HDTS.

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10. PREPARATION INSTRUCTIONS (Cont'd)

Section VI - Monitoring and Reporting

Section VII - Documentation

Section VIII - Development Approach
8.1 Engineering Practices
8.2 Operating Practices

Section IX - Development and Test Tools

Section X - Security Controls and Requirements

10.3 The content of each section shall be as follows.

10.3.1 Section I. Introduction. This section shall describe the scope, purpose, application and authority of the development effort. This should include a brief overview of the management philosophy and methodology that will be used on the project.

10.3.2 Section II. Organization and Responsibility. This section shall describe the organization, responsibilities and structure of the groups that will be designing, producing and testing all segments of the software system. It shall also identify the name and management position of each supervisor.

10.3.3 Section III. Management and Technical Controls. This sections shall describe the management and technical controls that will be used during development, including controls for insuring that all performance and design requirements have been identified and implemented.

10.3.4 Section IV. Resources.

10.3.4.1 Personnel. This section shall identify the level of manpower allocated to each task shown in the development schedule, including numbers, duration of assignment, and required skills. This includes administrative and logistic support personnel. If known, personnel assigned to software development tasks shall be listed by name. This section shall also identify security clearance requirements and plans for obtaining the necessary security clearances for personnel working on the software system (if applicable).

10.3.4.2 Training. This section shall identify training required for people working on the project and dates by which the training must be completed.

10. PREPARATION INSTRUCTIONS (Cont'd)

10.3.4.3 Data Processing Equipment. This section shall identify requirements for the use of data processing equipment to support the development of computer programs and their subsequent testing. It shall also describe the plan for assuring that the necessary hardware is available at the appropriate times.

10.3.5 Section V. Software Development Schedule. This section shall present a graphic and narrative description of the scheduled events and milestones of the software development effort. The schedule will be updated to reflect additional detail as the project moves through successive phases of the development cycle. By Preliminary Design Review, this section shall include a development schedule for each computer program and data base. The graphic description shall be a chart identifying schedules for the following:

a. All deliverables;

b. Preparation of management and test plans;

c. All levels of testing;

d. Reviews, including major reviews and other internal milestones;

e. Transition to life-cycle support activity.

The chart should illustrate a relationship with hardware schedules. Critical paths shall also be identified.

10.3.6 Section VI. Monitoring and Reporting. This section shall describe the procedure for monitoring and reporting the status of program development. It shall also describe the manner in which problems and recommended solutions to problems will be reported.

10.3.7 Section VII. Documentation. This section shall describe the approach for developing computer program documentation and will identify the documentation that will be produced. This shall include the plan for developing test-planning documentation, the Software Requirements Specification, the System/Subsystem Specification, the Program Specification, Software Manuals and any other documentation.

10.3.8 Section VIII. Development Approach.

10.3.8.1 Engineering Practices. This section shall describe the engineering practices that will be applied to the development of software. These practices include standards, conventions, procedures, rules for programming, design and other disciplines affecting development. At a minimum, procedures for implementing the following practices shall be described:

a. Programming and data base standards;

b. Top-down design methodology;

c. Design walk-throughs.

PREPARATION INSTRUCTIONS (Cont'd)

10.3.8.2 Operating Practices. This section shall describe the operating practices that will be applied to the development of software. These include the following;

a. Use of Unit Development Folders;

b. Techniques for ensuring that all performance and design requirements have been implemented;

c. Means of ensuring modularity, ease of modification, and capacity for computer program growth;

d. Methods and procedures for collecting, analyzing, monitoring and reporting on the timing of time-critical computer programs;

e. Means for ensuring that the software/data processors/peripheral equipment interfaces are adequate;

f. Criteria for determining when a development unit should be entered into configuration control;

g. Means of controlling master copies of computer programs, data bases and associated documentation during development (including their relationship to the Configuration Management Plan);

h. Rules for interface definition.

10.3.9 Section IX. Development and Test Tools. This section shall identify the special tools and techniques that will be used during development and testing of the computer programs. Some examples are as follows:

a. Special simulation;

b. Data reduction;

c. Code optimizers;

d. Code auditors;

e. Special utility programs;

f. Software security test tools.

10.3.10 Section X. Security Control and Requirements. This section shall identify security controls that will be used during software development (e.g., physical security, document access controls, computer access controls, etc.). It shall also describe the method of implementing and maintaining the security controls. It shall also identify and unique security problems and installation security requirements.

DATA ITEM DESCRIPTION	2 IDENTIFICATION NO(S)	
	AGENCY	NUMBER
1. TITLE DESIGN REVIEW DATA PACKAGE	NSA	DI-E-5423

3. DESCRIPTION/PURPOSE 3.1 The data packages are required by the Government to permit adequate preparation for each design review prior to the review meeting.	4. APPROVAL DATE 1977 May 02
	5. OFFICE OF PRIMARY RESPONSIBILITY NSA-R41
	6. DDC REQUIRED
	8. APPROVAL LIMITATION
7. APPLICATION/INTERRELATIONSHIP 7.1 To be used on contracts which require formal technical reviews and audits.	9. REFERENCES (Mandatory as cited in block 10) MIL-STD-1521
	MCSL NUMBER(S)

10. PREPARATION INSTRUCTIONS

10.1 Data packages shall be provided for design review meetings to be held on the program and submitted as indicated on DD Form 1423. The data packages shall be designed to provide adequate preparation information for design reviews organized in accordance with MIL-STD-1521 and Appendices B, C, D, and G. The detail contents of each package shall include, but not be limited to, the material required for the subject design review, an agenda, and a status of pertinent (if any) action items from previous design reviews or other meetings.

DD FORM 1 JUN 68 1664 S/N 0102-019-4000 PLATE NO. 19448 PAGE 1 OF 1 PAGES

C-4617

DATA ITEM DESCRIPTION

2. IDENTIFICATION NO(S).	
AGENCY	NUMBER
DOD	DI-R-7106

1. TITLE

Maintainability Modelling Report

3. DESCRIPTION/PURPOSE

3.1 To describe and show the development of a maintainability model for making numerical maintainability apportionments to various functions and levels of hardware throughout an item (system, subsystem, equipment) and to evaluate the maintainability of an item based on its maintainability design characteristics.

4. APPROVAL DATE

1983 January 3

5. OFFICE OF PRIMARY RESPONSIBILITY

AFSC

6. DDC REQUIRED

8. APPROVAL LIMITATION

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID satisfies the data requirement of para 201.2 in Task 201 of MIL-STD-470A. This DID is applicable to contracts which contain the requirements for Task 201 "Maintainability Modelling" of MIL-STD-470A.

9. REFERENCES (Mandatory as cited in block 10)

* MIL-STD-470A

MIL-STD-847

MCSL NUMBER(S)

OMB Exempt

*AMSC No. F3216

10. PREPARATION INSTRUCTIONS

10.1 Unless otherwise stated in the solicitation, the effective date of the document(s) cited in this block shall be that listed in the issue of the DoD Index of Specifications and Standards (DoDISS) and the supplements thereto specified in the solicitation and will form a part of this Data Item Description to the extent defined within.

10.2 The Maintainability model(s) shall be developed in accordance with paragraph 201.2 of Task 201 "Maintainability Modelling" of MIL-STD-470A as tailored to the particular needs of the acquisition program.

10.3 Format. The plan shall be prepared in accordance with MIL-STD-847.

U.S. GOVERNMENT PRINTING OFFICE 1983—605-323-9028

THIS DOCUMENT CONTAINS ____ PAGES.

DD FORM 1664

PAGE ____ OF ____ PAGES

DATA ITEM DESCRIPTION	2. IDENTIFICATION NO(S)	
	AGENCY	NUMBER
1. TITLE Maintainability Allocations Report	DOD	DI-R-7107

3. DESCRIPTION/PURPOSE

3.1 To document the Quantitative maintainability requirements developed for each component item of the approved hardware breakdown structure derived to meet the end item requirements.

4. APPROVAL DATE
1983 January 3

5. OFFICE OF PRIMARY RESPONSIBILITY
AFSC

6. DDC REQUIRED

8. APPROVAL LIMITATION

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID satisfies the data requirements of para 202.2 in Task 202 of MIL-STD-470A. System/Subsystem/equipment level quantitative maintainability requirements must be broken down to appropriate subsystem/equipment/unit/subunit levels as necessary to establish requirements for designers and subcontractors. This DID is applicable whenever Task 202 "Maintainability Allocation" of MIL-STD-470A is called out as part of an acquisition program.

7.2 This DID supersedes UDI-R-23570.

9. REFERENCES (Mandatory as cited in block 10)
MIL-STD-470A

MIL-STD-847

MCSL NUMBER(S)
OMB Exempt
*AMSC No. F3216

10. PREPARATION INSTRUCTIONS

10.1 Unless otherwise stated in the solicitation, the effective date of the document(s) cited in this block shall be that listed in the issue of the DoD Index of Specifications and Standards (DoDISS) and the supplements thereto specified in the solicitation and will form a part of this Data Item Description to the extent defined within.

10.2 Maintainability Allocations reports shall be prepared in accordance with paragraph 202.2 of Task 202 "Maintainability Allocation" of MIL-STD-470A as tailored for the particular acquisition. The report shall provide the results and describe the process of allocating Maintainability requirements to each component end item.

10.3 Format: The report shall be prepared in accordance with MIL-STD-847.

THIS DOCUMENT CONTAINS 1 PAGES.

DATA ITEM DESCRIPTION	2. IDENTIFICATION NO(S).	
	AGENCY	NUMBER
1. TITLE Maintainability Predictions Report	DOD	DI-R-7108

3. DESCRIPTION/PURPOSE

3.1 The description and documentation of the maintainability prediction made by the contractor. To make a determination of whether or not the proposed design is consistent with maintainability requirements.

4. APPROVAL DATE
1983 January 3

5. OFFICE OF PRIMARY RESPONSIBILITY
AFSC

6. DDC REQUIRED

8. APPROVAL LIMITATION

7. APPLICATION/INTERRELATIONSHIP

7.1 This DID satisfies data requirements of para 203.2 in Task 203 of MIL-STD-470A. Performance of Maintainability predictions applicable to Task 203 "Maintainability Predictions" of MIL-STD-470. The content of this report shall be included in the "Maintainability Prediction Report" of MIL-HDBK-472 when that has been designated as the basis for Task 203 of MIL-STD-470A.

7.2 This DID supersedes DI-R-2128.

9. REFERENCES (Mandatory as cited in block 10)
* MIL-STD-470A

MIL-STD-847

MIL-HDBK-472

MCSL NUMBER(S)
OMB Exempt
*AMSC No. F3216

10. PREPARATION INSTRUCTIONS

10.1 Unless otherwise stated in the solicitation, the effective date of the document(s) cited in this block shall be that listed in the issue of the DoD Index of Specifications and Standards (DoDISS) and the supplements thereto specified in the solicitation and will form a part of this Data Item Description to the extent defined within.

10.2 Maintainability Predictions Report shall be prepared in accordance with paragraph 203.2 of Task 203 of MIL-STD-470A as tailored for the particular acquisition.

10.3 The maintainability predictions report shall contain such detail as:

a. assumptions used in the prediction process
b. identification of the prediction procedure used
c. prediction results to the appropriate item levels.

10.4 Format: The report shall be prepared in accordance with MIL-STD-847.

THIS DOCUMENT CONTAINS ____ PAGES.

DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30, 1986

1. TITLE	2. IDENTIFICATION NUMBER
Scientific and Technical Reports Summary	DI-MISC-80048

3. DESCRIPTION/PURPOSE

3.1 Technical reports are acquired to provide the scientific and technical community a description of the precise nature and results of research, development, test, and evaluation (RDT&E) accomplished. Technical reports may be definitive for the subject presented, exploratory in nature, or an evaluation of critical subsystem or of technical problems.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC REQUIRED	6b. GIDEP REQUIRED
850911	DELNV		

7. APPLICATION/INTERRELATIONSHIP

7.1 This Data Item Description contains the data format and content preparation instructions for the data product generated by the specific and discrete task requirements for this data included in the contract.

7.2 This Data Item Description shall be used in preparing all ongoing interim or final Scientific and Technical Reports Summary. The purpose of these report summaries is to present management with a concise description of the scientific and technical findings and accomplishments during the reporting period.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER
		A3670

10. PREPARATION INSTRUCTIONS

10.1 Contract. This Data Item Description is generated by the contract which contains a specific and discrete work task to develop this data product.

10.2 Format. The Scientific and Technical Reports Summary shall be in contractor format.

10.3 Contents. The level of detail of the Scientific and Technical Reports Summary shall be adequate for non-specialists in the subject matter. When appropriate, specific references should be made to more detailed materials. The content of the Scientic and Technical Report Summary shall consist of the following:

(a) Task objectives.

(b) Technical problems.

(c) General methodology (e.g., literature review, lab experiment, survey, etc).

(d) Technical results.

(e) Important findings and conclusions.

Scientific and Technical Reports Summary (Cont'd)

Block 7 APPLICATION/INSTRUCTIONS (Cont'd)

7.2 (Cont'd) The types of scientific and technical report summaries and their frequencies are specified in the DD Form 1423

7.3 This Data Item Description shall be applicable in contracts when DI-S-4057 is used.

Block 10 PREPARATION INSTRUCTIONS (Cont'd)

10.3 (Cont'd)

(f) Implications for futher research

(g) Significant hardware development

(h) Special comments

10.4 Cover Page - The heading or cover page of each report summary shall contain the following information:

(a) Procuring Activity Designated Order Number

(b) Name of Contractor

(c) Contract Number

(d) Effective Date of Contract

(e) Expiration Date of Contract

(f) Reporting Period

(g) Principal Investigator and Phone No.

(h) Project Scientist or Engineer and Phone No

(i) Short Title of Work

10.4.1 Additionally, each report produced will have prominently displayed on the cover page, a notice of disclaimer worded as follows:

> The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the offical policies, either expressed or implied, of the Government.

10.4.2 Scientific and Technical Reports which are sponsored by other than the procuring activity shall have the following on the front cover:

DI-MISC-80048

Scientific and Technical Reports Summary (Cont'd)

Block 10 PREPARATION INSTRUCTIONS (Cont'd)

Sponsored by
(Sponsor's Identification)

(Sponsor's Designated) Order No. _____

Monitored by _____ Under Contract# _____

10.5 Reports shall be reproduced only by processes which provide black on white copy sufficiently clear and sharp for further reproduction when required. Ditto, hectograph, color, and other reproduction processes not reproducible photographically or xerographically are not acceptable.

DATA ITEM DESCRIPTION	2. IDENTIFICATION NO.	
	AGENCY	NUMBER
1. TITLE PROCEDURES, TEST	NAVY-SE	UDI-T-23732B

3. DESCRIPTION/PURPOSE

This data item is used to describe a contractor's test procedure and how he intends to determine compliance with specification requirements.

4. APPROVAL DATE
74 Oct 23

5. OFFICE OF PRIMARY RESPONSIBILITY
SEA 9833

6. DDC REQUIRED

6. APPROVAL LIMITATION

7. APPLICATION/INTERRELATIONSHIP

Application will be as specified by the contract data requirements list. This item may be used whenever tests are required.

8. REFERENCES (Mandatory as cited in block 10)

MCSL NUMBER(S)

10. PREPARATION INSTRUCTIONS

10.1 The test procedures shall be typed in contractor or commercial format on 8"x10½" sheets.

10.2 The test procedures shall cover in detail the plan and procedures for accomplishment of the tests specified in the contract schedule and specifications referenced therein or in Block 16 of the DD Form 1423, Contract Data Requirements List, data item requiring these procedures and shall specifically cover or contain the following as applicable:

a. Title
b. Index
c. Identification of item being tested (serial number)
d. Identification number of test procedure
e. Hardware configuration
f. Test prerequisites
g. Report form
h. Date, time and duration of test
i. Proposed test(s)
j. Preoperational checklist
k. The purpose of the test(s)

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PROCEDURES, TEST (Continued)

l. Description of test

m. The specification paragraph(s) to which the test(s) will prove compliance.

n. Detailed step-by-step procedure (may be referenced to test number and test title in Government documents)

o. Test schedule (operating profile, setpoints, stabilization time, data points)

p. The test equipment utilized.

q. Approvals, authorities and responsibilities

r. Sketches or photographs of test set-up

s. Facilities required for test

t. Test equipment requirements (major and special)

u. Methods of measurement(s)

v. Logistics equipment requirements (spare test hardware)

w. Method of control of sub-contractor's efforts and their procedures.

x. Applied instrumentation and data recording equipment

y. Data sheets (when required by a specification) for which the results are able to be correlated to the item tested.

z. Types of data to be recorded (parameters, ranges, accuracies, type readout, and quantities)

aa. Results (comparison of test data to acceptance standard)

bb. Accept/reject criteria for test acceptance.

cc. Personnel required

dd. Special resource requirements

ee. References to specs, standards, tech manuals, other test procedures and reports, change orders, notices, and other references not specific to the test but included for information only.

In addition to the requirements of paragraph 10.2, the production test procedures shall cover cleaning/refurbishing of test equipment and, if applicable, relationship for and during availability test(s).

DATA ITEM DESCRIPTION	2. IDENTIFICATION NO(S)	
	AGENCY	NUMBER
1. TITLE Configuration Management Plan (CMP)	USAF	DI-E-3108/ C-118-1
3. DESCRIPTION/PURPOSE This plan is prepared by the contractor to describe his assignment of responsibilities organizationally and the procedures used in his accomplishment of the specific configuration management requirement as stated in the contract. It is not to be used as a contractual requirement in lieu of the statement of work.	4. APPROVAL DATE 26 February 1971	
	5. OFFICE OF PRIMARY RESPONSIBILITY AFSC	
	6. DDC REQUIRED	
	8. APPROVAL LIMITATION	
7. APPLICATION/INTERRELATIONSHIP Obtained as part of the validation phase final report. When a validation phase is not accomplished, the CMP will be a requirement of the full-scale development contract. Not to be used on follow on contracts where the contractor's configuration management organization and procedures have been satisfactorily demonstrated on prior contracts. This DID may be modified and used on competitive RFPs to acquire information for source selection. When used in this manner, only an abbreviated plan will be acquired. By the same token, when this plan is procured (on other than validation contracts) it should be modified to delete source selection requirements.	9. REFERENCES (Mandatory as cited in block 10) MIL-STD-483 (USAF)	
	MCSL NUMBER(S)	

10. PREPARATION INSTRUCTIONS

The contractor shall describe in a configuration management plan, the organizational responsibilities and procedures used in the implementation of the configuration management requirements as stated in the contract. The configuration management plan shall be prepared in accordance with the criteria set forth in Appendix I of MIL-STD-483 (USAF).

THIS DOCUMENT CONTAINS 1 PAGES.

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PAGE 1 OF 1 PAGES

DATA ITEM DESCRIPTION	2 IDENTIFICATION NO(S)	
	AGENCY	NUMBER
1 TITLE Data Collection, Analysis and Corrective Action System, Reports	DOD	DI-R-7105

3 DESCRIPTION/PURPOSE

3.1 This data is used to aid maintainability design, identify corrective action tasks and to evaluate test results. The reports generated shall consist of tabulations and analyses of all maintenance actions occurring through the reporting period as well as remedial actions proposed by the contractor to eliminate maintainability deficiencies (and fault detection/isolation deficiencies).

4 APPROVAL DATE
1983 January 3

5 OFFICE OF PRIMARY RESPONSIBILITY
AFSC

6 DDC REQUIRED

8 APPROVAL LIMITATION

7 APPLICATION/INTERRELATIONSHIP

7.1 This DID satisfies the data requirements of para 104.2 in Task 104 of MIL-STD-470A. This report is applicable when Task 104, "Data Collection, Analysis and Corrective Action System" of MIL-STD-470A is called out as part of the acquisition program. This DID should be prepared in conjunction with the "Maintainability Demonstration Reports" called out in MIL-STD-471A.

7.2 This DID supersedes the following DIDs: DI-R-3537A and DI-R-20665.

9 REFERENCES (Mandatory as cited in Block 10)

*MIL-STD-470A

MIL-STD-847

MCSL NUMBER(S)
OMB Exempt
*AMSC No. F3815

10 PREPARATION INSTRUCTIONS

10.1 Unless otherwise stated in the solicitation, the effective date of the document(s) cited in this block shall be that listed in the issue of the DoD Index of Specifications and Standards (DODISS) and the supplements thereto specified in the solicitation and will form a part of this Data Item Description to the extent defined within.

10.2 The report content shall describe the results of the "Data Collection, Analysis and Corrective Action System".

a. The report, which may be prepared in the contractors selected format, shall include subcontractor, vendor data as applicable.

b. Data collected, analyzed and documented should be representative of the information elements contained below:

(1) A maintenance event identification number

(2) Maintenance task identification, keyed to each maintenance event (detection, isolation, removal, checkout, etc.)

(3) Date on which the maintenance event took place

(4) Identification of the location where the maintenance event took place

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PAGE ____ OF ____ PAGES

10. Preparation Instructions (continued)

(5) Identification of system, subsystem, assembly, printed circuit card on which maintenance was performed.

(6) Maintenance time necessary for corrective actions (or maintenance manhours, where appropriate)

(7) Deficiencies found/corrective actions taken.

10.3 Format: The report shall be prepared in accordance with MIL-STD-847.

* U.S. GOVERNMENT PRINTING OFFICE 1983—605-033-9027

DATA ITEM DESCRIPTION

Form Approved
OMB No. 0704-0188
Exp. Date: Jun 30, 1986

1. TITLE	2. IDENTIFICATION NUMBER
Scientific and Technical Reports Summary	DI-MISC-80048

3. DESCRIPTION/PURPOSE

3.1 Technical reports are acquired to provide the scientific and technical community a description of the precise nature and results of research, development, test, and evaluation (RDT&E) accomplished. Technical reports may be definitive for the subject presented, exploratory in nature, or an evaluation of critical subsystem or of technical problems.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY (OPR)	6a. DTIC REQUIRED	6b. GIDEP REQUIRED
850911	DELNV		

7. APPLICATION/INTERRELATIONSHIP

7.1 This Data Item Description contains the data format and content preparation instructions for the data product generated by the specific and discrete task requirements for this data included in the contract.

7.2 This Data Item Description shall be used in preparing all ongoing interim or final Scientific and Technical Reports Summary. The purpose of these report summaries is to present management with a concise description of the scientific and technical findings and accomplishments during the reporting period.

8. APPROVAL LIMITATION	9a. APPLICABLE FORMS	9b. AMSC NUMBER
		A3670

10. PREPARATION INSTRUCTIONS

10.1 Contract. This Data Item Description is generated by the contract which contains a specific and discrete work task to develop this data product.

10.2 Format. The Scientific and Technical Reports Summary shall be in contractor format.

10.3 Contents. The level of detail of the Scientific and Technical Reports Summary shall be adequate for non-specialists in the subject matter. When appropriate, specific references should be made to more detailed materials. The content of the Scientic and Technical Report Summary shall consist of the following:

(a) Task objectives.

(b) Technical problems.

(c) General methodology (e.g., literature review, lab experiment, survey, etc).

(d) Technical results.

(e) Important findings and conclusions.

Scientific and Technical Reports Summary (Cont'd)

Block 7 APPLICATION/INSTRUCTIONS (Cont'd)

7.2 (Cont'd) The types of scientific and technical report summaries and their frequencies are specified in the DD Form 1423

7.3 This Data Item Description shall be applicable in contracts when DI-S-4057 is used.

Block 10 PREPARATION INSTRUCTIONS (Cont'd)

10.3 (Cont'd)

(f) Implications for futher research

(g) Significant hardware development

(h) Special comments

10.4 Cover Page - The heading or cover page of each report summary shall contain the following information:

(a) Procuring Activity Designated Order Number

(b) Name of Contractor

(c) Contract Number

(d) Effective Date of Contract

(e) Expiration Date of Contract

(f) Reporting Period

(g) Principal Investigator and Phone No.

(h) Project Scientist or Engineer and Phone No

(i) Short Title of Work

10.4.1 Additionally, each report produced will have prominently displayed on the cover page, a notice of disclaimer worded as follows:

> The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the offical policies, either expressed or implied, of the Government.

10.4.2 Scientific and Technical Reports which are sponsored by other than the procuring activity shall have the following on the front cover:

Scientific and Technical Reports Summary (Cont'd)

Block 10 PREPARATION INSTRUCTIONS (Cont'd)

Sponsored by
(Sponsor's Identification)

(Sponsor's Designated) Order No. _____

Monitored by _____ Under Contract# _____

10.5 Reports shall be reproduced only by processes which provide black on white copy sufficiently clear and sharp for further reproduction when required. Ditto, hectograph, color, and other reproduction processes not reproducible photographically or xerographically are not acceptable.

U.S. GOVERNMENT PRINTING OFFICE: 1985 - 603-035/30259

DATA ITEM DESCRIPTION	2. IDENTIFICATION NO(S)	
	AGENCY	NUMBER
1. TITLE Testability Program Plan	DOD	DI-T-7198

3. DESCRIPTION/PURPOSE

3.1 This plan identifies the performing activity approach for implementing a Testability Program in accordance with MIL-STD-2165.

4. APPROVAL DATE
29 January 1985

5. OFFICE OF PRIMARY RESPONSIBILITY
NAVY-EC

6. DDC REQUIRED

8. APPROVAL LIMITATION

7. APPLICATION/INTERRELATIONSHIP

7.1 These data are to be used to define a Testability Program Plan.

7.2 This DID may be used for all electronic system and equipment development programs.

7.3 This DID satisfies the data requirements of Task 101 of MIL-STD-2165.

9. REFERENCES (Mandatory as cited in block 10)

MIL-STD-2165

MCSL NUMBER(S)
AMSC NO. N3424

10 PREPARATION INSTRUCTIONS

10.1 The applicable issue of the documents cited herein, including their approval dates and applicable amendments and revisions, shall be as reflected in the contract.

10.2 Contractor's format is acceptable.

10.3 A Testability Program Plan shall be prepared in accordance with MIL-STD-2165, Task 101 and include the following elements, with the range and depth of information for each element tailored to the acquisition phase:

10.3.1 A description of the work to be accomplished for each testability task included in the contractual requirements.

10.3.2 The time phasing of each task and its relationship to other tasks, particularly maintainability tasks.

10.3.3 Identification of a single organizational element within the performing activity which has overall responsibility and authority for implementation of the testability program.

10.3.4 Identification of data interfaces between the organizational element responsible for testability and other related elements.

10. Preparation Instructions (Cont'd)

10.3.5 Identification of the method by which testability requirements will be integrated with other design requirements and disseminated to design personnel and subcontractors.

10.3.6 Identification of testability design guides and testability analysis procedures to be used.

10.3.7 Description of procedures for scheduling, conducting and documenting testability design reviews.

10.3.8 Identification of testability submissions and their review, verification and utilization.

10.3.9 Description of procedures for identifying testability-related problems and assuring corrective action.

10.3.10 Description of procedures and controls for assuring that each subcontractor's testability practices are consistent with overall system or equipment requirements.

DATA ITEM DESCRIPTION	2. IDENTIFICATION NO(S)	
	AGENCY	NUMBER
1. TITLE Testability Analysis Report	DOD	DI-T-7199

3. DESCRIPTION/PURPOSE

3.1 This report documents the results of the testability requirements, design and evaluation tasks of MIL-STD-2165.

4. APPROVAL DATE: 29 January 1985

5. OFFICE OF PRIMARY RESPONSIBILITY: NAVY-EC

6. DDC REQUIRED:

8. APPROVAL LIMITATION:

7. APPLICATION/INTERRELATIONSHIP

7.1 These data are to be used to evaluate the level of testability incorporated in a design.

7.2 This DID may be used for all electronic system and equipment development programs.

7.3 This DID satisfies the data requirements of Tasks 201, 202 and 203 of MIL-STD-2165.

9. REFERENCES (Mandatory as cited in block 10)

MIL-STD-2165

MCSL NUMBER(S)

AMSC NO. N3425

10. PREPARATION INSTRUCTIONS

10.1 The applicable issue of the documents cited herein, including their approval dates and applicable amendments and revisions, shall be as reflected in the contract.

10.2 Contractor's format is acceptable.

10.3 The content of the Testability Analysis Report shall include the following:

10.3.1 General

10.3.1.1 A brief description of the system's functional operation.

10.3.1.2 A brief description of the functional operation of each item.

10.3.1.3 A description of system maintenance and support concept.

10.3.2 Testability Requirements Analysis (MIL-STD-2165, Task 201)

10.3.2.1 Description of methodology used to trade-off alternative diagnostic concepts, including varying degrees of built-in test, automatic test equipment and manual test.

10.3.2.2 Results of diagnostic trade-offs, including the impact of each alternative on readiness, life cycle costs, manpower and training.

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Testability Analysis Report

10. Preparation Instructions (Cont'd)

10.3.2.3 Description of the selected system diagnostic concept including recommended testability requirements for the system specification.

10.3.2.4 Description of methodology used to allocate system testability requirements to each item; recommended testability requirements for each item.

10.3.3 Preliminary Testability Design Analysis (MIL-STD-2165, Task 202)

10.3.3.1 Description of system built-in test functional design and system partitioning used to enhance testing.

10.3.3.2 For each item to be included in this analysis, a description of testability features incorporated (compatibility, observability, controllability, partitioning, etc.), BIT functional design and BIT interfaces to system BIT and to external test.

10.3.3.3 For each item to be included in the Inherent Testability Assessment, recommended weighting factors and scoring method for each testability criteria in the checklist.

10.3.3.4 For each item to be included in the Inherent Testability Assessment, a filled-in checklist and the calculated inherent testability.

10.3.3.5 Description of methodologies, models and tools to be used in predicting built-in test fault detection and fault isolation effectiveness.

10.3.4 Detailed Testability Design Analysis (MIL-STD-2165, Task 203)

10.3.4.1 For each item to be included in this analysis, a definition of predominant failure modes to be tested, a prediction of built-in test fault detection and fault isolation effectiveness and identification of areas which require additional testing.

10.3.4.2 Prediction of built-in test fault detection, fault isolation and false alarm characteristics at the system level.

10.3.4.3 Estimation of costs associated with the incorporation of built-in test and testability features, including developmental costs and recurring costs.

DATA ITEM DESCRIPTION (DRAFT)	
1. TITLE PM/FD/FL MODELING REPORT	2. IDENTIFICATION NUMBER DI-ATTS-XXXA

3. DESCRIPTION PURPOSE.
3.1 To describe and show the development of PM, FD, and FL mathematical model reports to be used for making numerical PM, FD, and FL apportionments to various fucntions and levels of hardware and software throughout an item and to evaluate the PM, FD, and FL chaarcteristics of an item based on its PM, FD, and FL design characteristics.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY	6A. DTIC REQ	6B. GIDEP REQ

7. APPLICATION/INTERRELATIONSHIP
7.1 This DID satisfies the data requirement of para xxx of Appendix x of the , Statement Of Work of contract

8. APPROVAL LIMITATION	9A. APPLICABLE FORMS	9B. AMSC NUMBER

10. PREPARATION INSTRUCTIONS
10.1 The PM, FD, and FL models shall be developed in accordance with paragraph y of of Appendix X of the Statement of Work of contract .

DATA ITEM DESCRIPTION (DRAFT)	

1. TITLE PM/FD/FL Allocation Report	2. IDENTIFICATION NUMBER DI-ATTS-XXXXB

3. DESCRIPTION PURPOSE
3.1 To document the quantitative PM, FD, and FL requirements for each component item of the approved hardware breakdown structure derived to meet the end item PM, Fd, and FL requirements.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY	6A. DTIC REQ	6B. GIDEP REQ

7. APPLICATION/INTERRELATIONSHIP
7.1 This DID satisfies the data requirement of para xxx of Appendix x of the ' Statement Of Work of contract ' .

8. APPROVAL LIMITATION	9A. APPLICABLE FORMS	9B. AMSC NUMBER

10. PREPARATION INSTRUCTIONS
10.1 The PM, FD, and FL allocations shall be performed in accordance with paragraph y of Appendix X of the Statement of Work of contract .

DATA ITEM DESCRIPTION (DRAFT)	

1. TITLE PM/F FL Prediction Report	2. IDENTIFICATION NUMBER DI-ATTS-XXXXC

3. DESCRIPTION PURPOSE
3.1 To document the quantitative PM, FD, and FL preditions made by the contractor and to determine whether or not the proposed design is consistent with the system PM, FD, and FL requirements.

4. APPROVAL DATE	5. OFFICE OF PRIMARY RESPONSIBILITY	6A. DTIC REQ	6B. GIDEP REQ

7. APPLICATION/INTERRELATIONSHIP
7.1 This DID satisfies the data requirement of para xxx of Appendix x of the . . . Statement Of Work of contract .

8. APPROVAL LIMITATION	9A. APPLICABLE FORMS	9B. AMSC NUMBER

10. PREPARATION INSTRUCTIONS
10.1 The PM, FD, and FL predictions shall be performed in accordance with paragraph y of Appendix X of the Statement of Work of contract .

10.2 The PM, FD, and FL prediction reports shall contain details such as:
a. assumptions used in the prediction process
b. identification of the prediction procedure used
c. prediction results to the appropriate item levels

Reverse Blank

APPENDIX E

SAMPLE CDRLs

FOR TASKS

Reverse Blank

CONTRACT DATA REQUIREMENTS LIST

SYSTEM ITEM

CONTRACTOR

A. ITEM NO.	B. TITLE OF DATA ITEM / Data Item Number	C. CONTRACT REFERENCE	D. TECHNICAL OFFICE: DISTRIB REQ	APPR CODE	INPUT TO TAILOR	E. FREQUENCY / AS OF DATE	F. DATE OF 1ST SUBMISSION / G. DATE OF SUBSEQUENT SUBM EVENT ID	H. DISTRIBUTION AND ADDRESSES	I. TOTAL
TBD	MAINTAINABILITY MODELING REPORT PM Mathematical Modeling Report	TBD	LT	A		ONE/R	120 DAC 30 DARC	TBD	TBD
DI-R-7106									

REMARKS

BLOCK 4: DELETE 10.2.

BLOCK 4: THIS DATA SUBMITTAL MAY BE COMBINED WITH ELIN TBD AND TBD (FD, FL).

BLOCK 8: REVIEW IS FOR TECHNICAL CONTENT. APPROVAL WILL BE BASED UPON CONTRACTOR COMPLIANCE WITH SPECIFICATION REQUIREMENTS. ALLOW 45 DAYS FOR REVIEW. FINAL SHALL INCORPORATE ALL REVIEW COMMENTS AND CORRECTIONS AND SHALL REFLECT THE LATEST DESIGN CONFIGURATION.

TBD	REPORT, MAINTAINABILITY ALLOCATIONS PM Allocation Report	TBD	LT	A		ONE/R	120 DAC 30 DARC	TBD	TBD
DI-R-7107									

REMARKS

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BLOCK 4: THIS DATA SUBMITTAL MAY BE COMBINED WITH ELIN TBD AND TBD (FD, FL).

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	DATE		DATE

DD FORM 1423 S/N 0102-LF-014-2300 REPLACES EDITION OF 1 JUN 69 WHICH IS USABLE PAGE ___ OF ___ PAGES

Enclosure (1)

CONTRACT DATA REQUIREMENTS LIST

SYSTEM ITEM

CONTRACT

CATEGORY

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
DATA ITEM NUMBER	TITLE OF DESCRIPTION OF DATA		CONTRACT REFERENCE	TECHNICAL OFFICE				FREQUENCY	AS OF DATE	DATE OF 1ST SUBMISSION	DATE OF SUBSEQUENT SUBM EVENT (B)	DISTRIBUTION AND ADDRESSES		
				(1) USASC REQ	(2) APPR CODE (A)	(3) INPUT TO IAC (B)								
TBD	HARDWARE DIAGNOSTIC TEST SYSTEM PM Development Plan		TBD					ONE/R		120 DAC	30 DARC	TBD		TOTAL
DI-S-ATTS-80005				LT	A									

BLOCK 2: (Cont'd) DEVELOPMENT REPORT

BLOCK 4: THIS DATA SUBMITTAL MAY BE COMBINED WITH ELIN TBD AND TBD (FD, FL).

BLOCK 8: REVIEW IS FOR TECHNICAL CONTENT. APPROVAL WILL BE BASED UPON CONTRACTOR COMPLIANCE WITH SPECIFICATION REQUIREMENTS. ALLOW 45 DAYS FOR REVIEW. FINAL SHALL INCORPORATE ALL REVIEW COMMENTS AND CORRECTIONS AND SHALL REFLECT THE LATEST DESIGN CONFIGURATION.

TBD	TESTABILITY ANALYSIS REPORT		TBD					ONE/R		120 DAC	30 DARC	TBD		TOTAL
DI-R-7199				LT	A									

BLOCK 8: REVIEW IS FOR TECHNICAL CONTENT. APPROVAL WILL BE BASED UPON CONTRACTOR COMPLIANCE WITH SPECIFICATION REQUIREMENTS. ALLOW 45 DAYS FOR REVIEW. FINAL SHALL INCORPORATE ALL REVIEW COMMENTS AND CORRECTIONS AND SHALL REFLECT THE LATEST DESIGN CONFIGURATION.

16.	DATE	APPROVED BY	DATE

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CONTRACT DATA REQUIREMENTS LIST

SYSTEM ITEM

CONTRACTOR

1. DATA ITEM NO.	2. TITLE OF DATA ITEM / SUBTITLE	3. CONTRACT REFERENCE	4. TECHNICAL OFFICE	5. FREQUENCY / AS OF DATE	6. DATE OF 1ST SUBMISSION / DATE OF SUBSEQUENT SUBM EVENT (B)	7. DISTRIBUTION AND ADDRESSES
TBD	MAINTAINABILITY PREDICTIONS REPORT PM Mathematical Modeling Report	TBD	LT A	ONE/R	120 DAC 30 DARC	TBD
DI-R-7108						TOTAL

BLOCK 4: DELETE 10.2.

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1. DATA ITEM NO.	2. TITLE OF DATA ITEM / SUBTITLE	3. CONTRACT REFERENCE	4. TECHNICAL OFFICE	5. FREQUENCY / AS OF DATE	6. DATE OF 1ST SUBMISSION / DATE OF SUBSEQUENT SUBM EVENT (B)	7. DISTRIBUTION AND ADDRESSES
TBD	SCIENTIFIC AND TECHNICAL REPORTS Fault Impact, Transient Smoothing	TBD	LT A	ONE/R	180 DAC 30 DARC	TBD
DI-MISC-80048						TOTAL

BLOCK 8: (Cont'd) SUMMARY

	DATE	APPROVED BY	DATE

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